

Interappointment flare-ups: incidence, related factors, prevention, and management

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The postendodontic flare-up is fortunately a relatively rare occurrence, but the sudden increase in patient symptoms necessitates a focused and active treatment plan. This review article discusses these many facets of the flare-up: definition, incidence, factors, prevention and how to manage the patient once the flare-up occurs.

An interappointment flare-up is an unhappy event. After a root canal treatment appointment, the patient calls or returns to the dentist's office in distress. This is upsetting to both the patient and the dentist and is disruptive to a busy practice. It would be desirable to understand the phenomenon – to know how to prevent the occurrence and be able to manage this event. However, the flare-up phenomenon is complex and involves a number of aspects

This review article discusses these many facets of the flare-up: definition, incidence, factors, prevention and how to manage the patient once the flare-up occurs. There is not absolute consistency in the literature as to all these considerations. The article will generally give a consensus of the majority findings or will represent those studies with the best analyses.

Definition

The interappointment flare-up has the following criteria (1):

- Within a few hours to a few days after an endodontic procedure, a patient has significant increase in pain or swelling or a combination of the two.
- The problem is of such severity that the patient initiates contact with the dentist.
- The dentist determines that the problem is of such

significance that the patient must come for an unscheduled visit.

- At the visit, active treatment is rendered. That may include incision for drainage, canal debridement, opening the tooth, prescribing appropriate medications, or doing whatever is necessary to resolve the problem.

Although the signs and patient symptoms may be severe in magnitude, they are rarely serious (i.e. not life-threatening). They tend to be localized and do not usually involve structures other than those oral or local perioral. Occasionally, however, the flare-up may become more complicated. It may spread to fascial spaces and even have such unfortunate sequelae as regional temporary paresthesia (2). The interappointment flare-up is obviously a situation which both the patient and dentist would wish to avoid.

Incidence

The overall incidence of flare-ups is low. Fortunately, the frequency of this emergency event occurs following only a small percentage of root canal treatment appointments. The studies with the best experimental design show that the incidence, when considering all pretreatment diagnoses together, ranges from 1.5% to 5.5% (1, 3–8). The variation of flare-up incidence re-

flects that some studies are retrospective, whereas others are prospective, or have undefined variables in small numbers of patients.

Importantly, the incidence of flare-up increases in direct relationship to the severity of the patient's pre-operative pathosis and signs/symptoms. The lowest frequency of occurrence is generally with a vital pulp without periapical pathosis; the highest frequency is with patients who present with more severe pain and swelling, particularly with pulp necrosis and acute apical abscess. These more severe situations result in a flare-up incidence of close to 20%. These factors will be discussed in more detail later in this article in order to providing clinicians with the information required to identify those risk factors that increase the probability of developing a postendodontic flare-up.

Risk factors for developing a flare-up

The causative factors associated with interappointment flare-ups have been examined in many studies. These generally are categorized as

- *patient related (demographic);*
- *pulpal/periapical diagnosis;*
- *presenting signs and symptoms;*
- *treatment procedures.*

The above four categories have been examined, although not all factors have been identified. Those studied include sex and age of patient, presence and size of a periapical lesion, whether the patient presents with pain and/or swelling, reported allergies, re-treatments, over-instrumentation, use of intracanal medicaments, therapeutics (analgesics, antibiotics, steroids), number of visits, and other treatment procedures.

Considering the above, there are many potential factors that may or may not serve as risk factors for developing flare-ups. Since most published clinical studies are correlative, there is little information on cause and effect of these potential factors. In other words, what can be defined as an etiologic factor for a flare-up? Therefore, we have focused on risk factors, defined as those factors associated with an increased risk for developing a post-treatment flare-up. These risk factors can be divided into two broad areas: the patient presenting factors, and what procedures were performed by the dentist. Interestingly, the literature clearly and consistently shows that some of the pa-

tient presenting factors are much more powerful than treatment procedures as related to the risk for developing a postendodontic flare-up (Tables 1 and 2).

Some of the confusion in the literature is a result of the reporting of factors related to lesser degrees of post-treatment pain. Interestingly, but not surprisingly, there are similarities between mild to moderate post-treatment pain and flare-up studies as to related factors. However, this review focuses on those factors related to flare-ups.

Patient presenting factors

Patient demographics

Age groupings and gender have been examined. Most studies show age to be an insignificant factor, showing no increases in flare-ups when analyzing groups by decades (1, 6, 7).

Several studies evaluating large numbers of patients found higher numbers of post-treatment pain and flare-ups in females (1, 9, 10). Considering the over-

Table 1. Risk factors for developing a post-endodontic flare-up

Risk factors	Reference
<i>Patient factors</i>	
Gender (female)	1, 9, 10
Pulpal necrosis	1, 6, 9
Acute apical abscess	1, 6, 7, 10
Acute apical periodontitis	1, 6, 7, 10
Large periradicular radiolucency	1, 4, 7, 9
Preoperative pain and swelling	1

Table 2. Factors related to a reduced risk for developing a post-endodontic flare-up

Risk factors	Reference
<i>Patient factors</i>	
Vital pulp	1, 6
Sinus tract	1, 10
<i>Treatment factor</i>	
Obturation*	1

*May be due to preoperative diagnosis (see text).

Percentage of Flare-Ups with Different Pulpal Diagnosis

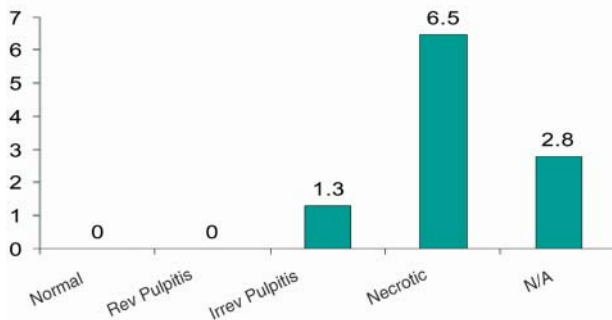


Fig. 1. As the severity of pulp pathosis increases, patients are more likely to experience a flare-up. From: Walton R & Fouad A. Endodontic interappointment flare-ups: a prospective study of incidence and related factors. *J Endod* 1992; 18: 172–177 (1).

all incidence, flare-ups tend to occur more frequently in females. However, it is uncertain if this difference is statistically significant and a meta-analysis that combines data from these studies has not yet been performed. It is reasonable that females would be more likely to seek treatment when experiencing significant symptoms. This has been consistently demonstrated in investigations that compare male with female behavior when pain is a factor (11, 12). Age does not seem to be a significant factor. Several investigations have failed to find any evidence indicating that age is a risk factor for development of flare-ups (1, 7).

Systemic conditions

This aspect has been largely uninvestigated. The little information available would indicate that the health (medical) status of the patient seems to be unrelated to occurrence of flare-ups. One study reported that allergies were significantly related to flare-ups (10), although this could not be replicated in another study (1).

Other systemic or medical conditions have not been studied. However, it would seem that these would not be major factors since flare-up incidence does not increase in older patients.

Pulp and periapical status

Diagnostic findings are very important (Fig. 1). Teeth with a vital pulp have relatively few flare-ups (1, 6). In

Periradicular Diagnosis

	No. of Visits	Flare-ups	%
Normal	442	4	0.9
AAP	122	6	4.9
CAP	228	8	3.5
AAA	84	11	13.1*
SAP	49	0	0.0

Significant $p=0.0001$

Fig. 2. Periradicular diagnosis. As the severity of the lesion increases, the incidence of flare-ups increases. Acute apical abscess (AAA) patients are much more likely to have a flare-up, particularly as compared with asymptomatic (CAP, SAP, normal) situations. From: Walton R & Fouad A. Endodontic interappointment flare-ups: a prospective study of incidence and related factors. *J Endod* 1992; 18: 172–177 (1).

contrast, teeth with pulpal necrosis has a much higher incidence of flare-ups (1, 6, 9). The periapical diagnosis of acute apical abscess and acute apical periodontitis, both painful entities, have been shown in most studies to also result in a significantly higher flare-up rate (1, 6, 7, 10) (Fig. 2). In addition, the radiographic presence of a periapical lesion, particularly larger lesions, also serves as a risk factor for development of flare-ups (1, 4, 7, 9). Importantly, a diagnosis of pulp necrosis and acute apical abscess, which includes pain and/or swelling, is much more likely to result in a flare-up than any other diagnostic pulp and periapical combination. These findings suggest that the immunological status of the periradicular tissue may predispose patients to develop a postendodontic flare-up.

Interestingly, the presence of a sinus tract virtually ensures that a flare-up will not occur (1, 10). Although this is indicative of an abscess, apparently the tract functions as a relief valve, releasing pressure, reducing tissue levels of inflammatory mediators, and thereby preventing the sudden increase in pain.

Patient signs and symptoms

As a predictor of flare-ups, signs and symptoms have an important relationship. As suggested by the presenting diagnosis, a patient that reports in pain is con-

siderably more likely to experience an interappointment flare-up than a patient without prior symptoms (1) (Fig. 3). The same is true for preoperative swelling (1). It is intriguing that patients in pain, which would also increase stress levels, have been shown to have adversely impacted immune functions (13).

Treatment factors

By definition, these are the treatment decisions under the control of the dentist. This involves the treatment plan and specific treatment approaches that are selected by the clinician. In general, and surprisingly, these seem to have little or no impact on either the occurrence or the prevention of flare-ups.

Treatment plan

Factors related to the treatment plan include whether the case involves conventional vs. retreatment, if the dentist chooses single or multiple visits, or performs partial vs. complete debridement.

There is not universal agreement as to whether retreatment results in a higher incidence of post-treatment pain or more flare-ups than conventional root canal treatment (6, 10). Most studies indicate that there is no difference (1, 3, 14).

As to single vs. multiple visits, a common belief has been that an approach to minimize post-treatment

pain, particularly with pulp necrosis/apical pathosis, is to extend treatment over more than one visit. There is no consistency in the literature; some studies show numbers of visits to be a factor (7, 8), whereas others show no difference (1), when combining and considering all diagnoses, signs and symptoms. However, this may not be the case if specific diagnoses are examined, for example, pulp necrosis and asymptomatic apical pathosis may be better managed in two or more visits. As yet, there are no data available for all different combinations.

Incomplete debridement has been traditionally assumed to be a cause of flare-ups. However, studies have shown this factor to be unrelated to the risk of developing a flare-up (1, 8, 15). Therefore, the dentist need not be concerned that canal preparation should be complete in order to minimize post-treatment symptoms.

Interestingly, if obturation is included as part of the treatment, (Fig. 4) the incidence of flare-ups is decreased (1). Less pain experienced is unlikely due to obturation being a less traumatic procedure. Rather, it relates to the fact that with more severe signs and symptoms (particularly pulp necrosis with acute apical abscess), the likelihood is that obturation will not be part of that appointment. This is the situation that also results in the greatest number of flare-ups.

Other operational procedures appear to have little

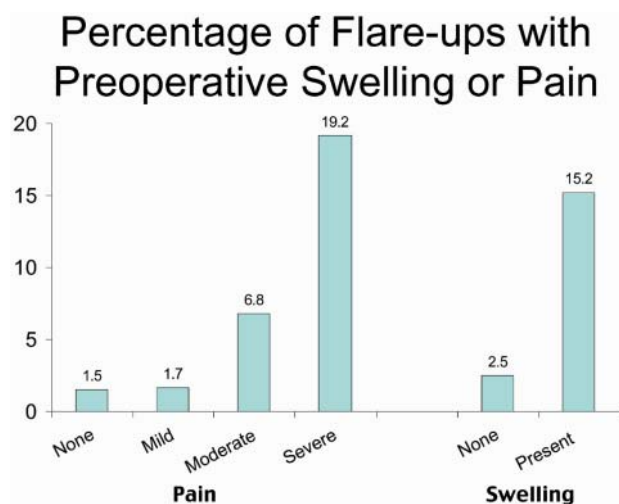


Fig. 3. Patients that present with swelling and/or pain experience a significantly greater number of flare-ups. From: Walton R & Fouad A. Endodontic interappointment flare-ups: a prospective study of incidence and related factors. *J Endod* 1992; 18: 172-177 (1).

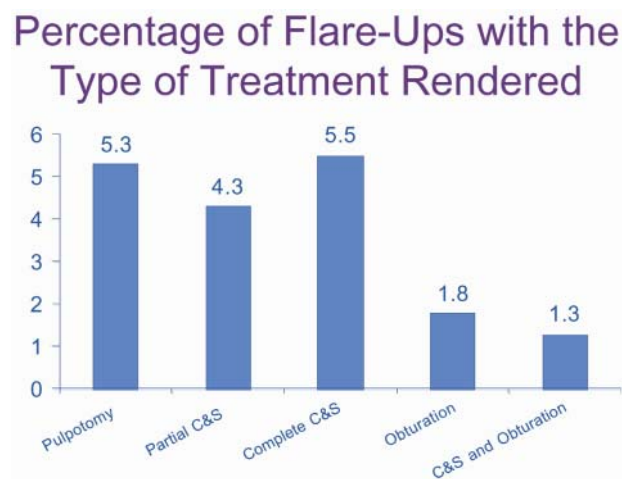


Fig. 4. The procedure related to significantly fewer flare-ups is when obturation is part of the procedure. Note that there is no difference between complete and partial cleaning and shaping. From: Walton R & Fouad A. Endodontic interappointment flare-ups: a prospective study of incidence and related factors. *J Endod* 1992; 18: 172-177 (1).

evidence as to being causative factors. Examples are over-instrumentation, extruded debris, extruded irrigant, overfill, and hyperocclusion. Of these, only over-instrumentation (instruments out the apex) has been assessed; this potentially tissue-damaging procedure was unrelated to flare-ups (10).

Therapeutics

Antibiotics are commonly administered to many patients post-treatment and prior to root canal treatment. Three studies showed prophylactic antibiotics to be unrelated to flare-ups (8, 16, 17); another study (1) reported that patients taking antibiotics were more likely to have a flare-up than those that were not. Again, this is likely related to the diagnosis of acute apical abscess, a condition in which patients would be more likely to already be on antibiotics. Based on these clinical trials in which, prospectively, patients were administered antibiotics or a placebo with no effect on post-treatment pain (8, 16, 17), it is unlikely that antibiotics have an impact. Based upon this lack of efficacy, their cost and potential side-effects, prophylactic antibiotics are therefore contraindicated for prevention of flare-ups.

Analgesics are a different matter. There is good evidence that pretreatment analgesics minimize post-treatment pain (18, 19) and that pretreatment pain and anxiety control, including analgesics, may reduce incidence of flare-ups (20). It is likely that a combination approach, that is, non-steroidal anti-inflammatories in combination with an opiate would be most effective in reducing the incidence of flare-ups. However, this hypothesis has not been examined in controlled clinical trials.

Etiology of interappointment flare-ups

The precise cause of the flare-up is unknown. There are different factors that have been speculated to precipitate the flare-up including immunologic response, infection, or physical tissue damage, or a combination of the three (Fig. 5).

Treatment factors that may trigger a flare-up include introduction of bacteria, or chemical and physical stimuli into the periapical tissue. These treatment factors likely interact with primed immune cells present in periapical tissue since flare-ups are much more

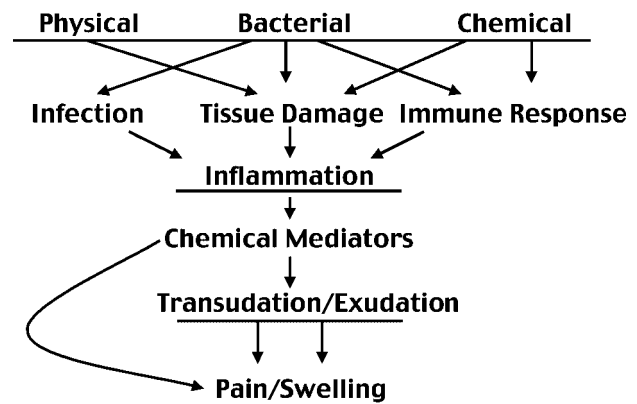


Fig. 5. Bacterial, chemical and physical irritants likely act in combination to produce changes at the periapex that results in inflammation and ultimately pain and/or swelling.

common in teeth with apical pathoses as compared to teeth with vital pulps and normal periradicular tissue. Although speculative, it is logical that these injurious agents and their effects on periapical tissue act in combination.

Although the role and responsible species of bacteria are not totally clarified, it is probable that these are important factors. To date, the only microbiologic study involving flare-ups used an intracanal sampling method (21) (Fig. 6). It is uncertain, but likely, that bacteria recovered from the canal are similar to the bacteria found periapically with a flare-up that involves an abscess. Those recovered from the canals were primarily gram negative anaerobic in mixed culture.

Prevention

Obviously, it would be desirable for both patient and dentist to prevent flare-ups. Unfortunately, there are no demonstrated techniques that are effective preventive measures. In fact, the only useful strategy is to not perform root canal treatment at all, or to be very selective as to which patients with which conditions to treat. If the practitioner chooses to manage patients with a variety of conditions, flare-ups will occur, particularly with certain diagnoses, as noted earlier. To reemphasize the point, patients presenting with pulp necrosis and acute apical abscess are much more likely to experience a flare-up; a way to avoid (or at least minimize) the flare-up in a general practice would be to refer such patients.

Many approaches and techniques to reduce the severity and incidence of post-treatment pain and flare-

ups have been attempted. Some of these involve complete debridement, multiple visit strategies, and administration of therapeutic agents. Other possible preventive strategies have included use of intracanal medicaments and reducing the occlusion. The therapeutic measures include the prescribing of antibiotics or anti-inflammatories (steroids or non-steroidal anti-inflammatory drugs) or administering analgesics. Each of these above approaches will be reviewed as to evidence of effectiveness on decreasing the incidence of flare-ups.

Technique related

Complete debridement

Although it would seem desirable and biologically advantageous to remove tissue remnants and bacteria from the canal space as, stated earlier, neither complete

nor incomplete debridement appear to alter the development of postendodontic flare-up incidence (1, 15).

Multiple visit

For the patients that are asymptomatic, there is no demonstrated advantage to single vs. multiple appointment procedures as to post-treatment pain. However, for those patients that present with acute apical abscess, it is likely that they will be managed with more than a single visit. Studies on these subgroups of patients are indicated since they could show differences in the risk for developing postendodontic flare-ups.

Intracanal medicaments

These agents have been studied as to their effects on post-treatment pain. A traditional and long-held be-

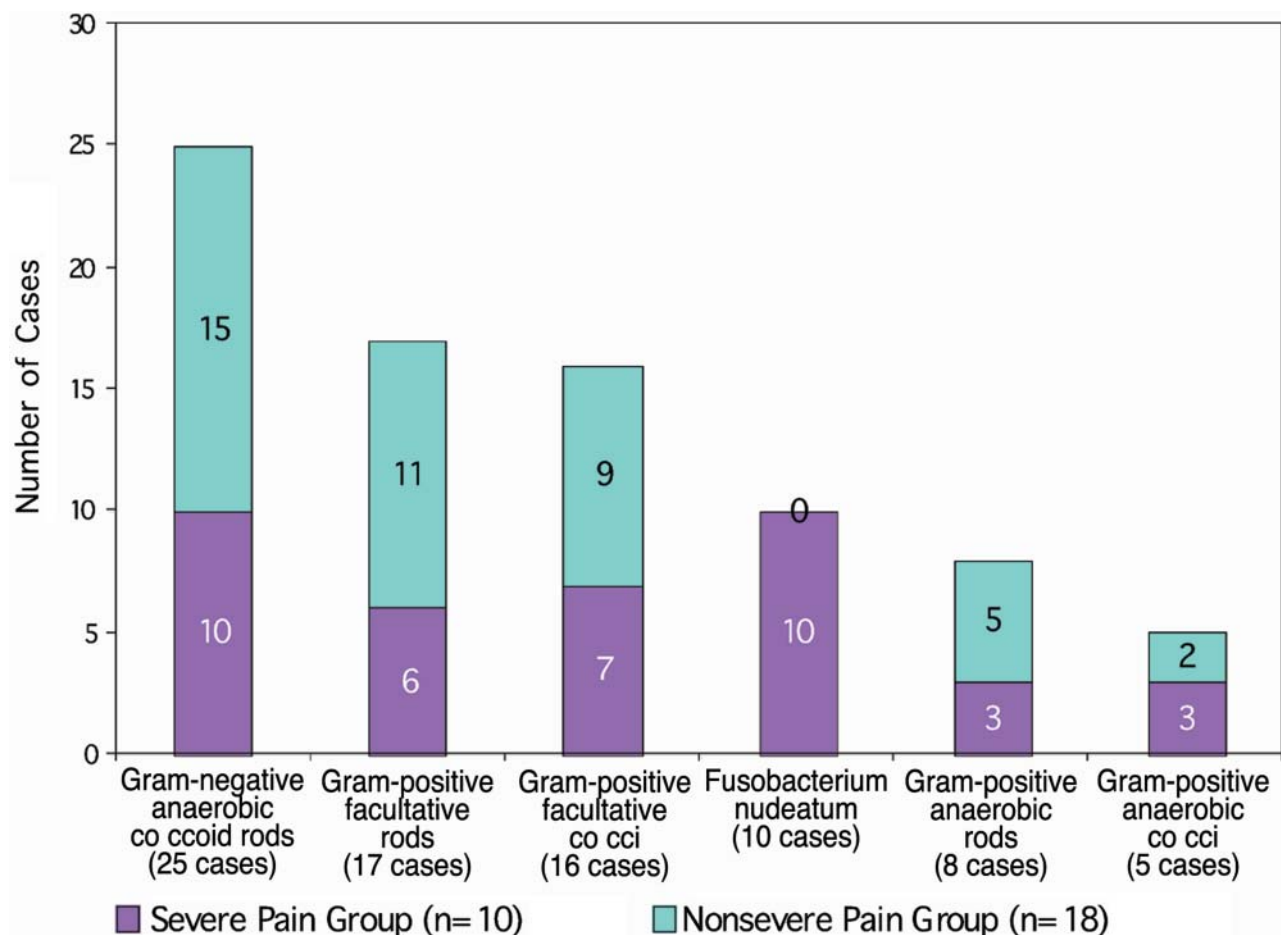


Fig. 6. The numbers of samplings (obtained from canals in cases with a flare-up) showing the distribution of isolated bacterial species according to Gram stain, cell morphology and oxygen tolerance. A mixture of *S. Milleri*, *P. anaerobius* *B. oralis*, and *F. nucleatum* seemed to be the most related to the severe flare-up and may be a potent combination. From: Chavez de Paz L. Fusobacterium in endodontic flare-ups. *Oral Surg Oral Med Oral Path Oral Radiol Endod* 2002; 93; 179–183 (21).

lief was that certain substances placed in canals would decrease or prevent flare-ups. However, clinical trials do not support this belief (10, 22). Post-treatment pain is neither prevented nor relieved by medicaments such as formocresol, phenolics (CMCP, Cresatin, eugenol, beechwood, creosote), iodine-potassium iodide, or calcium hydroxide (23). However, intracanal steroids (24) or NSAIDs (25) will reduce postoperative pain. One study compared intracanal placement of steroids, calcium hydroxide, or formocresol and determined incidence of flare-ups, finding no difference in the three interventions (4). Unfortunately, there was not a group of patients with a placebo intracanal medicament for comparison. With the exception of steroids and NSAIDs, the overwhelming evidence in all the studies is that nothing placed in the canal will prevent or significantly minimize post-treatment pain or flare-ups.

Occlusal reduction

Routine prophylactic occlusal reduction as a preventive of postoperative pain is ineffective (26, 27). Although this procedure has not been studied with flare-ups, it is unlikely that this would have any benefit. However, occlusal reduction in teeth with pain upon mastication is effective in reducing postoperative pain (28); whether this would prevent flare-ups in symptomatic teeth was not examined, but is unlikely.

Systemic measures (therapeutics)

Antibiotics

As mentioned earlier, clinical trials have shown that prophylactic administration of antibiotics are unrelated to incidence or levels of post-treatment pain or flare-ups (8, 16, 17). Antibiotics are therefore contraindicated as a preventive measure, although it is evident that they are used extensively (29). This is based on the misguided hope that antibiotics will minimize adverse symptoms.

Steroids and nonsteroidal anti-inflammatory drugs (NSAID)

Steroids, whether administered parenterally (30) or orally (31), will reduce incidence and severity but only with lower levels of pain. The effectiveness of steroids in preventing flare-ups is unknown.

NSAIDs have both analgesic and anti-inflammatory effects. Although analgesics will reduce postoperative pain, it is unlikely that the anti-inflammatory effect would be substantial given the relatively short amount of time between drug administration and development of the flare-up. Additional studies are clearly indicated.

Analgesics

Whether any class of analgesic (considering peripheral or central acting, opioid or prostaglandin-inhibiting) will prevent or minimize incidence of flare-ups is uncertain. It is unlikely that they would have this effect. Although one study showed analgesics to reduce the incidence of flare-ups (10), another demonstrated the opposite (1). In this clinical trial, patients taking antibiotics or analgesics had more flare-ups (1). But, as stated above, this likely was related to the presenting condition of the patient. Those on emergency visits or with adverse symptoms were more likely to be taking analgesics and/or antibiotics prior to the appointment. Presumably, this is why these medications were associated with a higher incidence of flare-ups. It is unlikely that the flare-up was caused by the therapeutic agent. On the other hand, it was interesting that flare-ups occurred in higher percentages in these patients; antibiotics and analgesics were not preventive, as has been the speculation.

Treatment of flare-ups

When a flare-up occurs, management is in three phases: psychological, localized treatment, and pharmacotherapeutics. Because a flare-up is an emergency situation and is multifaceted, a broad-based approach is indicated.

Psychological management

The patient is predictably and understandably upset and shaken by the sudden episode of pain or swelling. *Reassurance* (the Big 'R') is a critical, perhaps the most important, aspect of treatment. The patient is concerned and may even assume that treatment has failed and that extraction is needed. The dentist must explain that flare-ups do occur and are treatable. Next, the patient must be made comfortable by

breaking the pain cycle. Important to psychological management is good local anesthesia.

Treatment measures

These depend on previous diagnosis as well as current findings. Previous diagnosis includes vital or necrotic pulp with or without swelling. Admittedly, these management procedures are empirical (32); different treatment approaches have not been compared in clinical trials. Some of the improvement experienced by the patient is probably related to therapeutics, while other aspects of improvement may be a placebo effect. This can only be determined in randomized placebo-controlled clinical trials.

Vital pulp

Flare-ups seldom occur in these situations, but when they do, the problem likely is related to tissue remnants that have become inflamed. Working lengths should be verified and the canals carefully cleaned with copious irrigation. A dry cotton pellet is then placed followed by a temporary restoration. The pain will usually subside rather quickly and predictably.

Necrotic pulp with no swelling

These teeth may develop an acute apical abscess (flare-up) after the appointment. The abscess is confined to bone and is generally very painful. The patient may have been asymptomatic (seldom) or symptomatic (usual) at the presenting appointment. At the flare-up emergency appointment, the same treatment procedure is followed. The tooth is opened and the canal is instrumented and irrigated with sodium hypochlorite. Occasionally, drainage will be established through the tooth. This drainage should be allowed to continue until it ceases. Then the canals are re-irrigated, dried, calcium hydroxide paste is placed and the access sealed. The tooth should not be left open to the oral cavity. Interestingly, it was recently reported that drainage from the tooth did not result in significant reductions in pain as compared to no drainage (33). In both situations, symptoms required a few days to subside. If there is no drainage, the canals should be re-debrided, irrigated, medicated and closed. There seems to be little benefit in apical trephination (34).

Necrotic pulps with swelling

The tooth should be opened and the canals re-debrided and closed. The localized swelling is incised and a drain placed (Fig. 7). Non-localized swellings, that is, rapidly spreading into spaces, and those patients with systemic signs of infection, require additional measures. Their treatment may be best managed by an oral and maxillofacial surgeon who likely will perform extraoral drainage and may even hospitalize the patient.

Therapeutics

Intracanal medicaments

There is no demonstrated benefit in placing medications or any other substance in canals to help resolve a flare-up.



Fig. 7a. The patient presented with a failed root canal treatment with an asymptomatic periapical lesion.

Local anesthetics

Blocking the sensory nerves to break the pain cycle is important, both psychologically and neurophysiologically (35). Particularly useful are long acting anes-

thetics such as etidocaine or bupivacaine (36). In addition to their duration of tissue anesthesia, these agents produce a prolonged analgesic effect.



Fig.7b. Retreatment was initiated by obtaining working length and removal of gutta percha.



Fig.7d. Emergency treatment was initiated by opening the tooth for further debridement. Purulent drainage occurred spontaneously.



Fig.7e. A self-retentive 'Christmas tree' drain was cut from sterilized rubber dam.



Fig.7c. The patient returned the next day with a localized swelling and significant pain (flare-up).



Fig.7f. An incision was made into the swelling and the drain placed. The drain will allow continued drainage until removed, usually 1 or 2 days postincision.

Systemic medications

Systemic drugs are analgesics, steroids, and antibiotics. NSAIDs provide an analgesic but probably little-to-no anti-inflammatory effect in these acute situations.

For severe pain, a combination approach is most effective. An opioid, such as tramadol, codeine or oxycodone, and a non-steroidal agent seem to work in tandem. One combination, flurbiprofen (100mg loading + 50mg each 6h) and tramadol (100mg each 6h) was shown to be effective in managing pain in emergency patients (37).

Steroids, administered in a single dose (e.g. 4–6mg of dexamethasone) may also be of benefit (38). This would be to control a presumptive immune-mediated hypersensitivity reaction, although this mechanism has not been confirmed in flare-up patients.

Although antibiotics are widely used in treating a localized abscess (29), prospective clinical trials show they are of no benefit for reducing postoperative pain or risk of developing a flare-up (39, 40). However, they may be of help if there is a diffuse, rapidly spreading cellulitis into fascial spaces. This usage is empirical; there have been no clinical trials determining the efficacy of antibiotics in the presence of cellulitis.

Follow-up care

When a flare-up occurs and is managed, the patient should be contacted daily until symptoms subside. Communication may usually be made by telephone (41). Those patients with more severe or persistent problems (not resolving) and requiring additional measures should have follow-up appointments and additional treatment when needed.

When symptoms are persistent and severe and cannot be controlled, these patients should be referred to a specialist. Frequently, other treatment measures such as periradicular apical surgery are necessary.

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